# Claims

[c1] A method for polishing a wafer, the method comprising the steps of:
providing a semiconductor wafer having a topography including a first topography location and a different second topography location;
applying a slurry that includes an additive for forming a polishing inhibiting layer in situ across the topography, the polishing inhibiting layer creating a polishing rate for the topography that is non-linear with polishing pressure; and
chemical mechanical polishing the topography.

[c2] The method of claim 1, wherein the additive to form the polishing inhibiting layer includes one of: an anionic surfactant and a cationic surfactant.

[c3] The method of claim 2, wherein the cationic surfactant includes a chemical structure selected from the group consisting of:
a) $[CH_3(CH_2)_xN(R)]M$, wherein M is selected from the group consisting of: Cl, Br and I, x equals an integer between 2 and 24, and the R includes three carbon-based functional groups, each having less than eight carbon atoms; and
b) $C_pH_qQN$, where Q is selected from the group consisting of: Cl, Br and I, and $p > 8$ and $q > 20$.

[c4] The method of claim 3, wherein the carbon-based functional groups are selected from the group consisting of: $CH_3$, $CH_2OH$, $C_2H_4OH$, $C_2H_5$, $C_3H_6OH$ and $C_3H_7$.

[c5] The method of claim 3, wherein the cationic surfactant includes $C_pH_qQN$, and Q is Cl, p = 21, and q = 38, resulting in cetylpyridinium chloride ($C_{21}H_{38}ClN$).

[c6] The method of claim 2, wherein the cationic surfactant includes one of: cetyltrimethyl ammonium bromide (CTAB), $[CH_3(CH_2)_{15}N(CH_3)_3]Br$; cetyldimethylethyl ammonium bromide (CDB), $[CH_3(CH_2)_{15}N(CH_3)_2CH_2OH]Br$; $[CH_3(CH_2)_xN(CH_3)_3]Br$, where x equals an integer between 2 and 24; and $[CH_3(CH_2)_xN(CH_3)(C_2H_5)(C_3H_7)]Br$, where x equals an integer between 2 and 24.

[c7] The method of claim 2, wherein the anionic surfactant includes at least one of: sodium sulfate, sodium dodecyl sulfate, sodium lauryl sulfate, sodium stearate and sodium tetradecyl sulfate.

[c8] The method of claim 1, wherein the polishing inhibiting layer decreases a polishing rate of one of the topography locations to a level defined according to: $PR = k * (P - P_{crit})$,

where PR is the polishing rate, k is a coefficient of friction of a slurry, P is a polishing pad polishing pressure at one of the topography locations, and $P_{crit}$ is a critical removal polishing pressure to be applied for removal of the polishing inhibiting layer.

[c9] The method of claim 8, further comprising the step of removing the polishing inhibiting layer by polishing at a pressure greater than the critical removal polishing pressure.

[c10] The method of claim 8, wherein the critical removal polishing pressure

$P_{crit}$ is no less than approximately 2 psi and no greater than approximately 20 psi.

[c11] The method of claim 8, wherein the polishing step includes applying a downforce of no more than 4 psi above the critical removal polishing pressure $P_{crit}$, and no less than 4 psi below the critical removing polishing pressure $P_{crit}$.

[c12] The method of claim 1, further comprising the step of controlling a pH level of the slurry to be between an isoelectric point of the topography and an isoelectric point of a polishing particle of the slurry to ensure adhesion of the polishing inhibiting layer to a surface of the topography, wherein the controlling step includes adding at least one of an acid and a base.

[c13] The method of claim 12, wherein the acid is selected from the group consisting of: nitric acid, hydrochloric acid, phosphoric acid and sulfuric acid, and the base selected from the group consisting of: potassium hydroxide and sodium hydroxide.

[c14] The method of claim 1, wherein the difference in topography between the first topography location and the second topography location is at least one of: height and pattern density.

[c15] The method of claim 1, wherein the topography includes silicon dioxide, the slurry includes a polishing particle including ceria, the additive includes cetyltrimethyl ammonium bromide (CTAB) $[CH_3(CH_2)_{15}N(CH_3)_3]Br$, and a pH level of the slurry is no less than

approximately 2 and no more than approximately 7.

[c16] The method of claim 1, wherein the topography includes silicon nitride, the slurry includes a polishing particle including silica, the additive includes sodium dodecylsulfate, and a pH level of the slurry is no less than approximately 3 and no more than approximately 9.

[c17] A wafer polishing slurry, comprising:

a plurality of polishing particles;

a solvent in which the polishing particles are suspended; and

a polishing inhibiting layer forming additive for forming a layer on a surface of a wafer in situ to inhibit a polishing rate thereof, the polishing inhibiting layer creating a polishing rate for the topography that is non-linear with polishing pressure.

[c18] The slurry of claim 17, wherein the polishing inhibiting layer forming additive includes one of: an anionic surfactant and a cationic surfactant.

[c19] The slurry of claim 18, wherein the cationic surfactant includes a chemical structure selected from the group consisting of:

a) $[CH_3(CH_2)_xN(R)]M$, wherein M is selected from the group consisting of: Cl, Br and I, x equals an integer between 2 and 24, and the R includes three carbon-based functional groups, each having less than eight carbon atoms; and

b) $C_pH_qQN$, where Q is selected from the group consisting of: Cl, Br and I, and $p > 8$ and $q > 20$.

[c20] The slurry of claim 19, wherein the carbon-based functional groups are selected from the group consisting of: $CH_3$, $CH_2OH$, $C_2H_4OH$, $C_2H_5$, $C_3H_6OH$ and $C_3H_7$.

[c21] The slurry of claim 19, wherein the cationic surfactant includes $C_pH_qQN$, and Q is Cl, p = 21, and q = 38, resulting in cetylpyridinium chloride ($C_{21}H_{38}ClN$).

[c22] The slurry of claim 18, wherein the cationic surfactant includes one of: cetyltrimethyl ammonium bromide (CTAB), $[CH_3(CH_2)_{15}N(CH_3)_3]Br$; cetyldimethylethyl ammonium bromide (CDB), $[CH_3(CH_2)_{15}N(CH_3)_2CH_2OH]Br$;
$[CH_3(CH_2)_xN(CH_3)_3]Br$, where x equals an integer between 2 and 24; and
$[CH_3(CH_2)_xN(CH_3)(C_2H_5)(C_3H_7)]Br$, where x equals an integer between 2 and 24.

[c23] The slurry of claim 18, wherein the anionic surfactant includes at least one of: sodium sulfate, sodium dodecyl sulfate, sodium lauryl sulfate, sodium stearate and sodium tetradecyl sulfate.

[c24] The slurry of claim 17, wherein the polishing inhibiting layer is removable from the surface at a critical removal polishing pressure $P_{crit}$ that is no less than approximately 2 psi and no greater than approximately 20 psi.

[c25] The slurry of claim 17, wherein the slurry has a pH level between an isoelectric point of the surface and an isoelectric point of the plurality

of polishing particles to cause adhesion of the layer to the surface.

[c26] A polishing inhibiting layer forming additive for a chemical mechanical polishing slurry, the additive comprising:

a surfactant having a chemical structure selected from the group consisting of:

a) $[CH_3(CH_2)_xN(R)]M$, wherein M is selected from the group consisting of: Cl, Br and I, x equals an integer between 2 and 24, and the R includes three carbon-based functional groups, each having less than eight carbon atoms; and

b) $C_pH_qQN$, where Q is selected from the group consisting of: Cl, Br and I, and $p > 8$ and $q > 20$,

wherein the surfactant forms a polishing inhibiting layer creating a polishing rate that is non-linear with polishing pressure.

[c27] The additive of claim 26, wherein the surfactant includes one of:

cetyltrimethyl ammonium bromide (CTAB), $[CH_3(CH_2)_{15}N(CH_3)_3]Br$

and

cetyldimethylethyl ammonium bromide (CDB), $[CH_3(CH_2)_{15}N(CH_3)_2CH_2OH]Br$.

[c28] The additive of claim 26, wherein the polishing inhibiting layer is removable at a critical removal polishing pressure $P_{crit}$ that is no less than approximately 2 psi and no greater than approximately 20 psi.

[c29] The additive of claim 26, wherein the slurry has a pH level between an isoelectric point of a surface to be polished and an isoelectric point of

a plurality of polishing particles therein to cause adhesion of the layer to the surface.

[c30] The additive of claim 26, wherein the surfactant includes $C_pH_qQN$, and Q is Cl, p = 21, and q = 38, resulting in cetylpyridinium chloride ($C_{21}H_{38}ClN$).